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Focus & Convergence for Complex Endeavors

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Focus
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Composing Effective Environments for Concept Exploration in a Multi-Agency Context

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Abstract

There is a need to integrate a range of stakeholders, both military and non-military, into the planning and conduct of operations, both civil and military. These endeavors necessitate the inclusion of many stakeholders, each of which bring diverse agendas, values, and differing degrees of experience and training. Anecdotes suggest that techniques used to inform planning and subsequent operations often fail to reflect the complexity of such multi-agency environments. We report on a technique that has been used successfully to explore the issues evident in multi-agency planning and operations. Specifically, we report on the use and suitability of Engle matrix gaming methods to simulate the complex nature of the problem space. The key to success of these activities is related to the level of preparation and we discuss what issues should be considered with regard to the scenario, personnel and overall planning.

In memory of Dr. Terry Webb.

Introduction

The events of 9/11 and Hurricane Katrina underscore the need to improve interagency coordination between various bodies. Many government departments share responsibilities and there is a requirement to improve the coordination and response to these incidents. Understanding and modifying concepts of operation, technology

and systems, and policy amongst all of these organizations requires a form of interaction to make explicit, the implicit and cultural knowledge contained within each of the participants.

Wargames emerged in abstract forms thousands of years ago, for example go in Asia and chess in Europe. Their utility for supporting military education has been appreciated for almost as long, with significant documented use for this purpose since the 17th century (Perla 1990). However, for wargames to successfully support military planning and training, they must incorporate and reflect in their designs important factors at play in the world. When wargaming focuses solely on the tactical and operational events taking place in the military domain, and does not consider geo-political and economic factors, the results can be misleading. Reflect on the wargaming of the *Schlieffen plan* which neglected to simulate the diplomatic and political consequences of Germany's actions, with the resultant outcome of the plan upon execution being utterly unexpected (Caffrey 2000).

How can we situate players within an environment that captures this richness and that gives them the capacity to learn about the complexity of the socio-political space infusing modern operations? The type of problem addressed often suggests the activity which is most likely to shed some light on the problem. Hung and Van Eck's taxonomy of game types (2010) (Table 1) includes role playing games, the category in which Engle matrix games (Engle 1990) belong. Engle matrix games are designed to be sufficiently rich to reflect a multitude of military, social, political, and economic drivers within a wargaming environment. Some examples of their use are the simulation of situations, involving both war fighting and peace support, for the British Army since the mid 90's[1] and as part of the NATO training group, teaching languages to the French Army.[2] Here, we outline their use and discuss how this technique can be, and has been, usefully applied to interagency coordination issues.

1. Major Tom Mouat MBE, e-mail message to first author, July 18, 2009.
2. Neal Durando, Defence Linguistics, e-mail message to first author, July 17, 2009.

Table 1. Taxonomy of games by problem solving method (Hung and Van Eck 2010 - *Reprinted by permission of the publisher*).

Knowledge and Cognitive Process														
	Domain specific knowledge				*Higher order thinking*						*Psycho-motor skills*		*Attitude change*	
Problem type ↓	Declarative	Procedural	Concepts	Principles	Logical	Analytic	Analogical	Strategic	Systemic	Metacognitive	Muscular movement	Muscular-cognitive coordination	Shift of belief system	Game type ↓↓
Logical					+	+								Adventure; Puzzle
Algorithmic		+	+	+	+									Adventure; Puzzle; Action
Story	+	+	+	+	+	+	+							Adventure; Puzzle
Rule-use	+	~	~	+	+	+								Action; Strategy; Role-playing; Adventure; Puzzle
Decision making		~	+	+	+	+		+	~	~				Action; Strategy; Role Playing; Simulations; Adventure
Troubleshooting		+	+	~	+	+	+	+	~	~				Simulations
Diagnosis-solution		+	+	+	+	+	+	+	+	+				Simulations; Strategy
Strategic Performance		+	+	+	+	+	+	+	+	+	+	+		Action; Role playing; Simulations; Adventure
Case Analysis			+	+	~	+	+		~	+			~	Strategy
Design			+	+	+	+	+	+	+	+				Strategy
Dilemma				+	+	+	~	+	+	+			+	Strategy; Role playing

The Engle matrix game is a multi-sided, role-based seminar game with structured turns. It is possible for a given role to win in the game (by achieving its objectives) without other roles losing. Each player or team assumes a role within the game and makes an argument during each turn for how their action will change the game world. These arguments are assessed as to their likelihood by the adjudicator. Subsequently either the adjudicator or chance is used to decide the outcome of the arguments, with the results of the arguments and the nature of the pre-existing conditions from earlier in the game shaping the likelihood of success. The outcomes become facts in the game world. The same process is followed for counter arguments. As each turn passes, the facts accumulate to build a new world.

Engle matrix games are a form of structured experiential learning—resulting in a strong exchange of tacit and explicit knowledge between participants. With some modification, Engle matrix games

are capable of making implicit knowledge explicit, both through verbalization and recorded data. Surfacing assumptions is a strength of Engle matrix games and a distinct advantage when considering interagency issues.

We repeat the lessons we have learned about execution of an Engle matrix game. Where possible, the validity of particular approaches is discussed with reference to research literature. The first part of the article introduces the components of an Engle matrix game. Part two discusses the game itself, its design and execution. The third part discusses analysis and presents an example. Finally, the article highlights potential future directions for development and employment of the technique.

Components

In this section, we outline some of the issues that need to be considered when creating an Engle matrix game. The first item is to determine the purpose of the game. Is the goal to provide a learning experience for the participants, to explore the situation for possible responses or to analyze the implications? Having determined the goal of the game, a plan can be constructed covering the scenario, roles, the matrix, orientation, the number of turns and the debriefing session.

Engle matrix games take from several hours to several days to execute, depending on both the number of participants and the complexity of the scenario. The length and complexity of an Engle Matrix game is closely linked to the number of players; less than 4 roles generating insufficiently complex interactions and greater than 10 roles becoming unmanageable. The initial phase covers orientation and is the section in which participants plan and establish their strategies. On average, orientation takes approximately an hour, subsequent turns take approximately 20-40 minutes and the game typically lasts between 5 and 10 turns. Actions must be strategic and goal oriented

and at least an hour should be set aside for debriefing at the end of the matrix game. Orientation should meet the standards applied to any military experimentation activity, but should include briefing of:

- The structure and mechanisms of game play; and
- Time to read the documentation of the goals, constraints, and resources applicable to that role.

The length of the preparation time is a function of the researcher's familiarity with the area that the scenario is set in, the goals of the matrix game (e.g., experiential or predictive) and, most importantly, the complexity of the issues under consideration within the game. Scenario design in matrix games is critical to successful problem solving. The scenario provides the context for the game. It must balance explicit facts and history for the game against excessive definition, which would unnecessarily constrain play. The scenario should contain comprehensive and accurate information: to establish what is true in the simulated world, but not fetter the playing of the game. Preparation of the scenario can require considerable effort; for example, the Joint Experiment (JE) program spent approximately 8 weeks in preparation for a 1 week matrix game event (Ng et al. 2006). On the other hand, Engle matrix games can be prepared in several hours. The definition of roles must detail:

- The scenario specific goals of the role: what are the players who adopt that role aiming for? What constitutes success for them?
- The values observed by the role, e.g. does the group or individual embodied in the role believe in freedom of speech?
- The constraints applicable to that role.
- The resources available to the role. Resources can be military assets, financial resources, political resources, or social capital.

- The allowable interactions between roles: who can talk to whom and how?
- A history of these relationships.
- The current positions of each role.

Pre-testing the scenario and the role descriptions is advisable. The written descriptions should be reviewed by independent advisers to ensure they are understandable, comprehensive, and concise. Emotionally or culturally charged words may cause an unintended bias and it can be worthwhile for researchers to prepare descriptions of the situation independently and to then amalgamate these as part of scenario development.

Typical wargames usually consider two or three “sides” (red, blue, and gray/green). The multiple roles inherent in an Engle matrix game can result in an increase in the complexity of actions and relationships beyond that typically experienced in wargames. One of the arguments against a two sided game is the lack of realism, but the many roles of an Engle matrix game reduce the strength of that argument. Engle matrix games generally have seven to nine roles and each role can have up to three participants (although both are arbitrary numbers chosen mostly for manageability).

When selecting participants, research on expert decision-making (Simon 1955; Simon 1956; Dreyfus and Dreyfus 1986; Klein 1998) suggests that novices are less able to see patterns within a context, making their actions less appropriate, and therefore, less likely to reflect actions typical of the roles they are portraying within the wargame. As participants draw on their tacit knowledge and experience to complete the role they are playing, players with experience or knowledge relevant to the scenario are central to success. If “pretend” players have to be used, it should be kept in mind that such players will require a great deal more background.

However, the use of experts is not risk-free. Research on learning generalizability suggests that prior experience is typically *not* called on in solving a new, related problem unless subjects have been explicitly told to consider the similarities between the two or have been trained to identify similarities (Gick and Holyoak 1980; Perkins and Salomon 1988; Salomon and Perkins 1989). Similarly, if the situation or problem is new, prior experience may account for less and experts generally fail to recognize when their expertise no longer applies (Klein 1998). To make best use of prior experience, the scenario must allow participants to connect that experience to the problem at hand.

An element in analysis is attributing the causes to either external (situational) or internal (personal) factors. There are marked differences across cultures and this can change the considered actions of the participants. Participants draw on their schemas, e.g. experiences and cultural beliefs when playing a game (Cooper et al. 1999; Heinrich et al. 2001). Careful consideration needs to be given to the choice of participants for the game because these factors can enrich or confound an experiment. In a scenario exploring multi-cultural issues, for example, it may be beneficial to draw participants from the cultures depicted in the scenario, partly to highlight issues such as stereotyping. Chandler and Spies (1996) found a large variation in the attributions used by participants in games in seven countries. Certain behaviors, particularly aggression but also conformity, compliance and cooperation, can be the result of personal intentions or cultural values.

We have focused on participants, but other personnel such as facilitators, adjudicators, analysts, and general assistants are needed. The facilitator should be cognizant of the influence they can exert on the game. In some cases this can be a desirable thing when the game is designed to explore a particular scenario but if a general exploration of the space is intended then the facilitator should limit their influence to smoothing the progress of the game. Analysts are required to interpret data either during or post- activity. General assistants

are used for writing and displaying arguments and results, general ushering, such as gathering participants for communal discussions, and to answer questions.

If one has the choice of where to run the game, several issues need to be considered, such as convenience and availability, but the aim of the scenario will also impact on the choice of venue. If a matrix game is played in context, e.g. in a work area, the use of context *may* make subjects more sensitive to the strategic implications of the game. However such a context may only benefit the participants whose roles are carried out in a similar work area. An out of context environment, intended to minimize any relation to subjects' field experiences, *may* reduce sensitivity to the strategic implications of the game (Cooper et al. 1999).

The matrix is a list of actions a role can take in a classical Engle matrix game. For interagency experimentation it may be difficult to enumerate a majority of possible actions so a matrix may not be prepared. Game history (captured manually or electronically) must be available to the players. Other important components include:

- Turn sheets are critical if rigorous data capture is desired. Turn sheets allow the participants to record their arguments, but also to indicate previous facts that support their arguments, providing a means for traceability from one phase of play to the next.

- Maps provide visual context for the scenario. In some instances paper based area movement maps are adequate; in others, computational resolution may be necessary. In either case, maps should not distract the participants from the essential nature of the game.

- Images, video, and audio can be used to establish context and to improve participants' immersion.

- Scenario date and time information can also help with improving immersion. Real-world time information is important for regulating play but needs to be used sensitively as it can decrease the level of psychological validity.

Raser (1969) identifies four criteria for assessing the validity of gaming as a research technique: predictive validity, psychological validity, structural validity, and process validity. These four criteria apply equally to Engle matrix gaming as a form of (non-computer based) simulation. The first type, predictive validity, refers to the capacity of the simulation to predict plausible outcomes (see Analysis for a brief discussion). Psychological validity is maximized when the game seems valid to the participants and increases the possibility that the behaviors displayed by the participants will correspond to those found in real-life. Structural validity is determined by the degree to which the game's structure can be shown to correspond to that of the reference system. In other words, is there reasonable congruence between the "elements, ... and the way they are connected are reflected in the game model" (Peters 1998, 24). Process validity is similar to structural validity except that it refers to processes, e.g. information flows that take place. These three types of validity affect the predictive validity and are maximized in the careful construction of the components of an Engle matrix game.

Game play

Game play proceeds turn by turn, with each role playing an action, simultaneously, randomly or in a pre-determined sequence. Simultaneous play creates the conditions for ambiguity, for example the "fog of war." It can promote proactive strategies and limit reactive strategies but can also result in disconnected styles of play, in which the actions of one person are given less consideration by others. Random play is determined by the most recent argument or event and the participant or team who is most affected. Throughout, the rules of the game are open to discussion as to how they impact on the course of the game.

The players' responsibilities are summed up by the necessity to make one argument each turn, causing something to happen to further their objective. In a classical Engle matrix game, arguments are classified as one of three types (Engle 1995):

- Planning arguments: that set the scene for future actions.
- Conflict arguments: that force a showdown between two or more players over control of resources.
- Trouble arguments: that cause other players to experience some kind of difficulty that must be solved.

Each argument consists of an argument for an action, a result, and three supporting reasons for why the action should be successful. Participants may also make additional arguments in response to the arguments of another role, i.e., counter arguments and counter-counter arguments. Arguments from different roles may compete with one another because of logical inconsistency or mutual exclusivity, requiring adjudication based on an assessment of the relative strengths of the arguments. Where planning arguments are made and the participant does not want other participants to know of their intentions, a secret argument can be made. In the interests of having a reasonably paced game however, a limit may be set on the number of secret arguments allowed.

Each role when completing their turn sheet determines their actions, effects, enablers, and outcomes. This in turn will inform or construct their argument. A classical Engle matrix game (Engle 1995) resolves the success or failure of an argument by combining the strength (or qualitative likelihood) of the argument with the result of a roll of a die. However decisions on the success or failure of an argument can be the responsibility of an adjudicator or an adjudication cell. Whichever is used, the adjudicator has the responsibility for deciding how strong each argument is and who is in the strongest position in conflicts. Similar to the facilitator, the adjudicator should attempt

to assist the game but refrain from passing judgment on what they consider acceptable actions. When using an Engle matrix game, any deletion of paths on the grounds that they are unlikely (e.g., in the adjudicator's culture) may be harmful. This is not to say that every proposed action is likely; however, the adjudicator must be careful to determine the grounds on which the arguments are assessed. The adjudicator should keep careful records of decisions made and outcomes for later reconstruction and investigation of alternate branches in the game; Defence Science and Technology Organisation's Joint Decision Support Centre has developed *GameNet* for capturing such information.

At the end of each turn, all actions are decided either by the facilitator using subject matter experts (SMEs) or some objective mechanism. Those arguments that are successful are established as fact and define the game world thereafter. No fact can ever be reversed without reversing all subsequent facts within the scenario (in effect, winding back the scenario clock).

Games lasting several hours or days need to be followed up with debriefing of the game's process. When participants discuss their actions and subsequent effects then their understanding of their own and others' actions is enhanced. This process further enables the observations and experiences of participants to contribute to changing their mental models, demonstrating double loop learning (Argyris 1982) in the creation of a new mental representation (Boyd 1976), usually facilitating future interagency collaboration.

Use of Analysis

Engle matrix games are employed in several ways: educational or operational. As an educational device they are played to give the participants a learning experience. Used as a tool for exploration or as an operational tool the results can be analyzed. If contemplating analysis there are several cautionary indicators.

During analysis, awareness must be maintained of the (by necessity) limited space that was explored and the impact of this limitation. In addition, the socio-political complexities of many geopolitical and military problems mean that it is difficult for an expert to take all influences into consideration when predicting an outcome. It is known that experts have difficulty predicting the results of large changes or unusual events. Carroll et al. (1988) found that expert deliberations often deviated from normative logic: experts are probably better at identifying what should happen than what will happen. When contemplating multi-agency scenarios, it is very unlikely that an expert in one field will be able to accurately predict the actions of people from other organizations as the actions are often outside the expert's experience.

Studies suggest that role playing in simple scenarios provides almost twice the predictive capacity of expert judgment or the mathematical Von Neumann Game Theory (Borman 1982; Green 2002; Green 2005; Armstrong 2000). Indications are that if the results are congruent then approximately five sessions are needed per scenario, with divergent results necessitating more sessions (Armstrong 2000). This increase does not indicate the infallibility of analysis but Engle matrix games should at least equal the predictive accuracy of role playing games because of their multi-player nature and greater complexity.

The history of war game use suggests there is agreement among defense personnel that wargaming is worthwhile in shedding light on questions about the situation examined. Engle matrix games are capable of making implicit knowledge explicit, both through verbalization and via auditable, recorded data. The effort is useful as this is one of the strengths of Engle matrix games, surfacing the assumptions of the participant, as often the questions the game reveals are more important than the outcomes.

An Illustration

The Defence Science and Technology Organisation has applied the Engle matrix game technique in a range of settings, including the exploration of an interagency strategic planning concept (Ng et al. 2006). This section describes an application in which two parallel matrix games were run to explore the consequences of different stakeholders and methods on strategic planning.

Preparatory work prior to the games detailed the scenario, identified key stakeholders, their goals, values, constraints and resources, and the relationships between the stakeholders' goals. Each game used the same scenario and included the same stakeholders with the exception of the players for the Australian Strategic Planning role who differed. In the Whole of Government Planners' game, the Australian Strategic Planning stakeholder role was played by a Whole of Government cell with representatives from a range of key government departments. In the Military Planners game, the Australian Strategic Planning stakeholder role was played by senior military strategic planners, comprised of military strategic personnel who planned without input from outside defense. Senior SMEs were available to all players and formed part of the adjudication process.

Information (see figures 1, 2, and 3 for an example) was provided to the players prior to the matrix game and the appropriateness of these "tools" was evaluated at the end of the matrix game. The results indicated a preference for certain tools—Conflict Analysis graphs were found particularly useful; Tree Diagrams and Influence Diagrams were found less useful. The types of relationships shown in Figure 1 indicated to the players that a complete win-win situation was not feasible within the scenario, but that certain positive outcomes could be achieved, depending upon decisions made by players.

Stakeholder Y

Values
Maintenance of international legitimacy

National Objectives
Encourage trilateral approach to separatist problem

Enablers
Strong alliances and international influence

Constraints
Domestic support for involvement

Figure 1. An illustration of a Stakeholder Map for Stakeholder Y

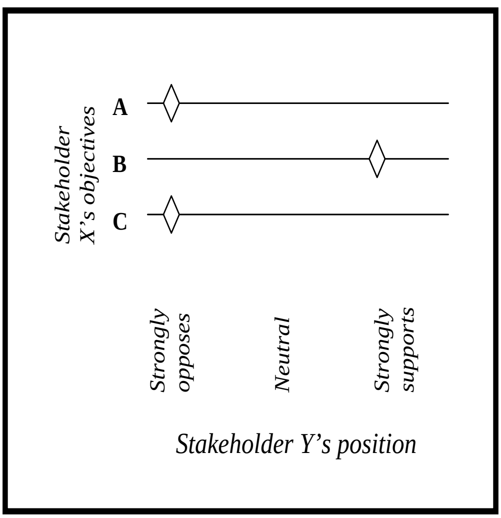

Figure 2. An illustration of a Conflict Analysis graph showing the degree to which Stakeholder Y's position or intent is supported by Stakeholder X's objectives.

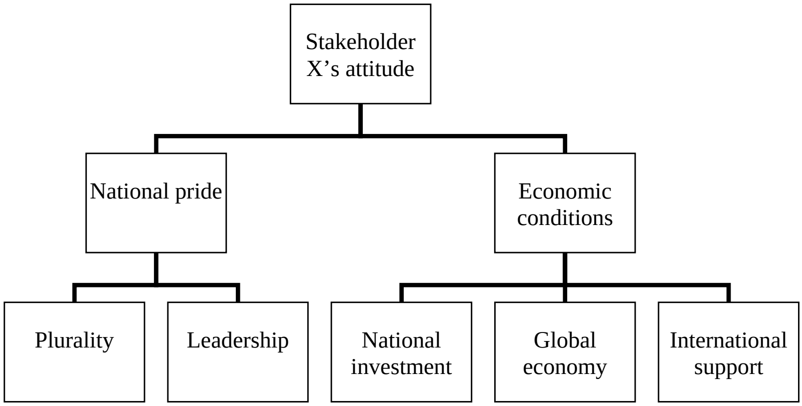

Figure 3. An illustration of a Tree Diagram indicating potential leverage points (bottom nodes) that Stakeholder Y may use to influence Stakeholder X's attitude to a particular issue.

A sample of the events developed during game play is contained in Table 2 which provides some indication of the data collected. An analysis of the differences in the plans produced by the key stakeholder, the Australian Strategic Planning stakeholder, was made by:

- Evaluating the topology of the matrix of facts within each game;
- Examining the qualitative differences in the style of play and the details of the plans formulated during play; and
- Comparing the strategic directions of game play and how they differed between the two matrix games.

Table 2. Sample results from game showing the outcomes of various actions by Stakeholders X and Y in turn 3 of the matrix game. The last column shows captured interrelationships between previous Effects generated during turns 1 and 2 and how they supported or opposed Effects in turn 3.

Turn #	Outcome	Effect	Stakeholder Generating Effect	Agency conducting task	Previous Effects Supporting / Opposing
3	Fail	3.1 Improve international perception of Stakeholder X being able to deal with insurgency	X	Government Department A	2.9 / nil
	Partial Success	3.2 Suppress Insurgency activities	Y	Military	1.7, 1.9, 2.2 / 2.1
	Success	3.3 Improve economic circumstances of stakeholder Z	Y	Foreign Aid Organization	1.7 / 2.1
	Success	3.4 Increase regional security in area of operations	Y	Military	1.7,1.10 / nil

The topology of the plans was measured from the game play data by: the degree of branching (the ratio of effects to actions); the degree of cross-linking (how many effects a task contributed to); and the Inter Agency Coordination Requirement rating (IACR), a measure of the degree to which different agencies were undertaking separate actions to achieve the same effects in the plan.

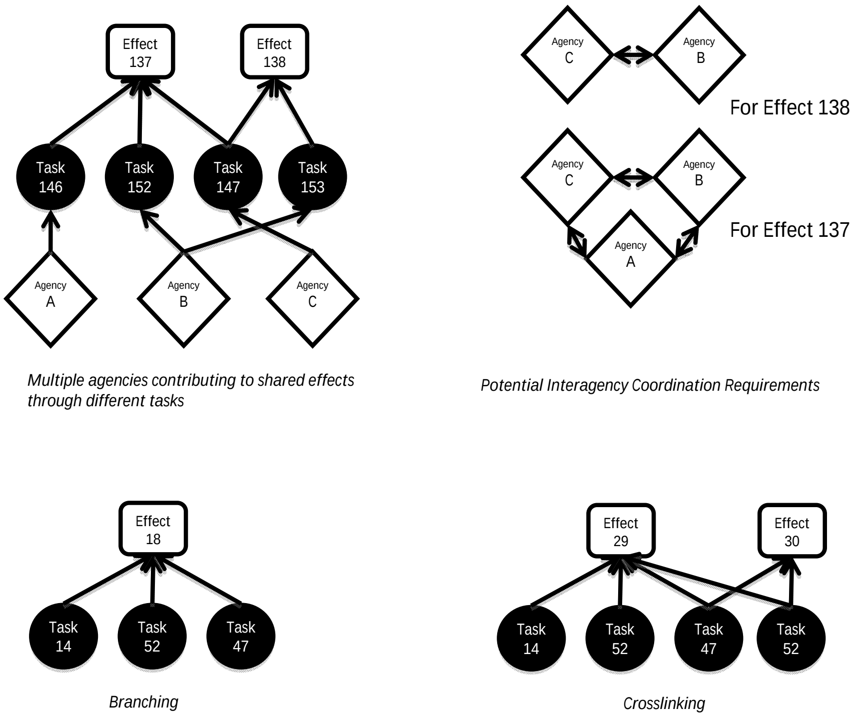

Figure 4. Concepts for measuring the topology of each of the two games based upon an analysis of the interrelationships between effects, actions, and agencies undertaking actions recorded during game play.

This analysis was made possible by the audit trail of actions, effects, and agencies responsible that was recorded as part of game play. Table 3 presents these different measures of topology.

Table 3. Topological measures for the two planning teams' plans. Note that the Whole of Government team tended to assign more tasks to achieve a given effect, but committed less tasks to achieving multiple effects. Higher IACR values imply more significant requirements for coordination amongst agencies.

	Whole of Government	Military
Branching	2.2	2.1
Cross-linking	1.5	1.8
Links	35	23
Effects	16	11
Tasks	24	13
IACR	1.4	1.9

Based on this analysis, the following observations were made:

- The plan developed by the Australian Government Planning Stakeholder within the Whole of Government game had a slightly greater degree of branching, consistent with more tasks contributing to any given effect;

- The plan developed by the Australian Government Planning Stakeholder within the Whole of Government game had a lower degree of cross-linking, consistent with tasks in the plan aimed at achieving fewer effects;

- The strategic plan developed by the Australian Government Planning Stakeholder within the Military game had a higher IACR, consistent with the plan demanding more coordination and cooperation in order to achieve the desired effects within the strategic scenario. This may indicate that the Military had developed a plan with greater overheads and higher risk of misalignment, but also with greater potential for synergies.

Observed differences in style of play were interesting and had a direct bearing on the outcome of each of the games. In particular, the team playing the Australian Government Planning Stakeholder role in the Whole of Government game was more reactive and less direct than the team in the Military game, which gave them latitude to adjust as the game proceeded. This resulted in a very quick divergence in play between the two games, with the Whole of Government game moving into a strategic space driven by dialogue and an attempt to find common ground, while the Military game quickly became confrontational.

Networks of effects were documented (see the last column in Table 2) and recurring effects acted as tipping points within each game. The outcome of both games was heavily contingent upon (a) the degree of in-game dialogue established between key stakeholders within the scenario, (b) the degree to which nationalism amongst certain stakeholders outweighed cooperation, and (c) the extent to which the international community supported one stakeholder over another. These tipping points were used to support other forms of analysis—a Field Anomaly Relaxation study and Faustian Tree analysis that plotted out alternative developmental paths for the scenario.

Without more sophisticated tools and methods to support the matrix game process, capturing data within the games and analyzing data proved time consuming and prone to error. Adjudication was difficult and sometimes arbitrary, and preventing SMEs from seeding ideas during game play proved particularly problematic.

The possibility of using the matrix game to explore large segments of the scenario landscape remains open, although “winding back” the matrix game clock and exploring alternate paths would demand considerable resources and time. However, the matrix game itself might provide enough data on key factors governing the scenario to facilitate other approaches to exploring the potential scenario landscape. The data could, for example, be used to build and populate a Bayesian Network model. The technique may also provide a strong

learning environment, although no data with respect to this was collected as part of the program of work reported on herein. In this study, the tipping point information, was especially useful in generating a series of follow-on operational level scenarios for military operational analysis.

The concept revealed significant issues with respect to the fundamental question of the impact that the two alternative planning structures had on the nature of the plans developed. These issues have informed discussion with the *Australian Department of Defence*.

Conclusion

Although such games prove little in a narrow scientific sense, the motivation for gaming is to encourage creative, innovative thinking about problems that resist analysis with more conventional approaches and methods. Given our tendency to ascribe similar thought processes to others whether probable or not (Witlin 2008), the use of Engle matrix games to investigate possible reactions is a valuable and often neglected technique. The role-playing nature of Engle matrix games provides insights into the special problems of command and control, which despite its origins is not only a military term. Engle matrix games are important educational experiences, providing participants an opportunity to become aware of facts associated with possible conflicts. Positions, expectations, perceptions, facts, and procedures typically are challenged and improved as the game proceeds. For these reasons it is suggested that the Engle matrix game technique may be usefully applied to interagency coordination issues.

There are undoubtedly areas where games and simulations are difficult to apply. There are strong beliefs that wargames at the strategic level cannot capture realistic applications of diplomatic, informational, military, and economic effects, as there are too many influences that bear on strategic situations that cannot be replicated.

Indeed, a single game could not consider all the issues, complexities, and nuances that are present in complex situations. For this purpose, a series of games may be needed.

In her article, McCown (2005, 38) writes that games are "designed to enhance understanding of crisis decision making in an interagency setting, the forums allow exploration of emerging national security issues and the capabilities and limitations of instruments of national power in dealing with these challenges." She describes an interagency rehearsal as a mechanism for coordinating activity conducted near the end of the political-military planning process. Such interagency rehearsals will almost always result in the modification of plans. In the US National Strategic Gaming Center, National Defense University, the rehearsal is part of the integrated planning process, not the final presentation of a completed plan. Rehearsals are held to help discover and resolve potential problems a plan could encounter before they become actual problems on the ground.

This article has discussed a particular approach to wargaming, Engle matrix games, establishing its utility and outlining a proposed set of practices useful for constructing and executing such games. The practice provides a vehicle to include important socio-political elements in wargaming and create a role-play environment that provides better predictive capacity than individual expert judgment. Engle matrix games are capable of making implicit knowledge explicit, both through verbalization and via auditable, recorded data. Because of this, we propose greater use of Engle matrix games and suggest that this technique can be successfully applied to interagency issues. They can sharpen our questions and for this reason we do not advocate Engle matrix games for their predictive worth, we see their value as greatest when used as an educational tool to broaden one's repertoire of responses.

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